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Liquid applicator

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FIG. 1

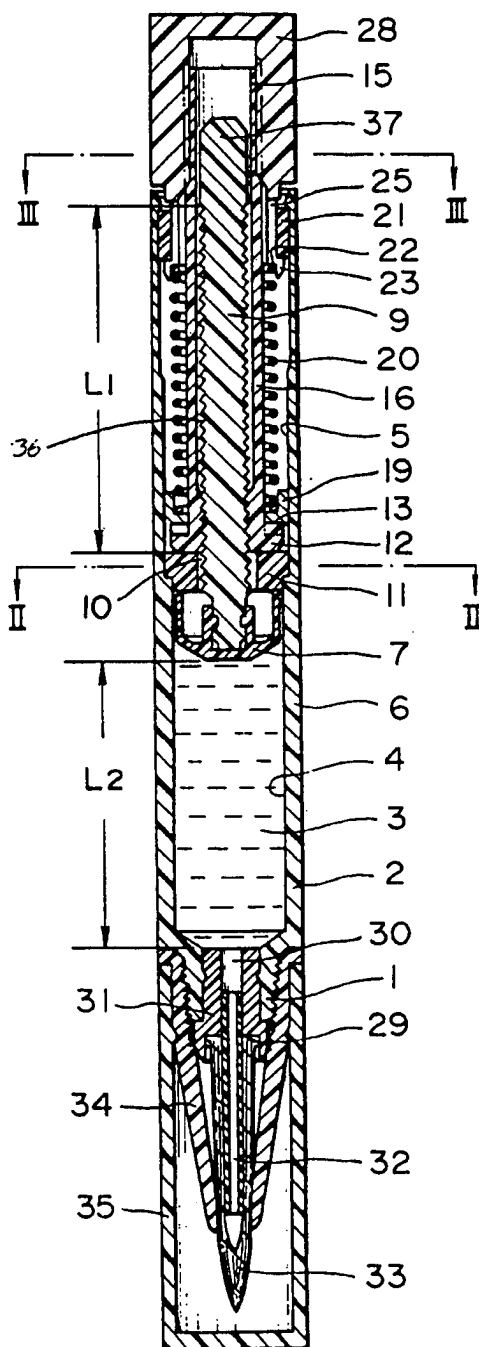


FIG. 2

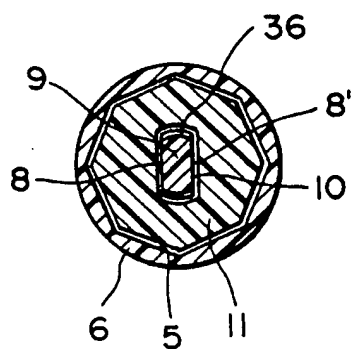


FIG. 3

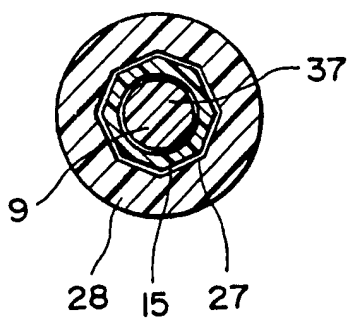
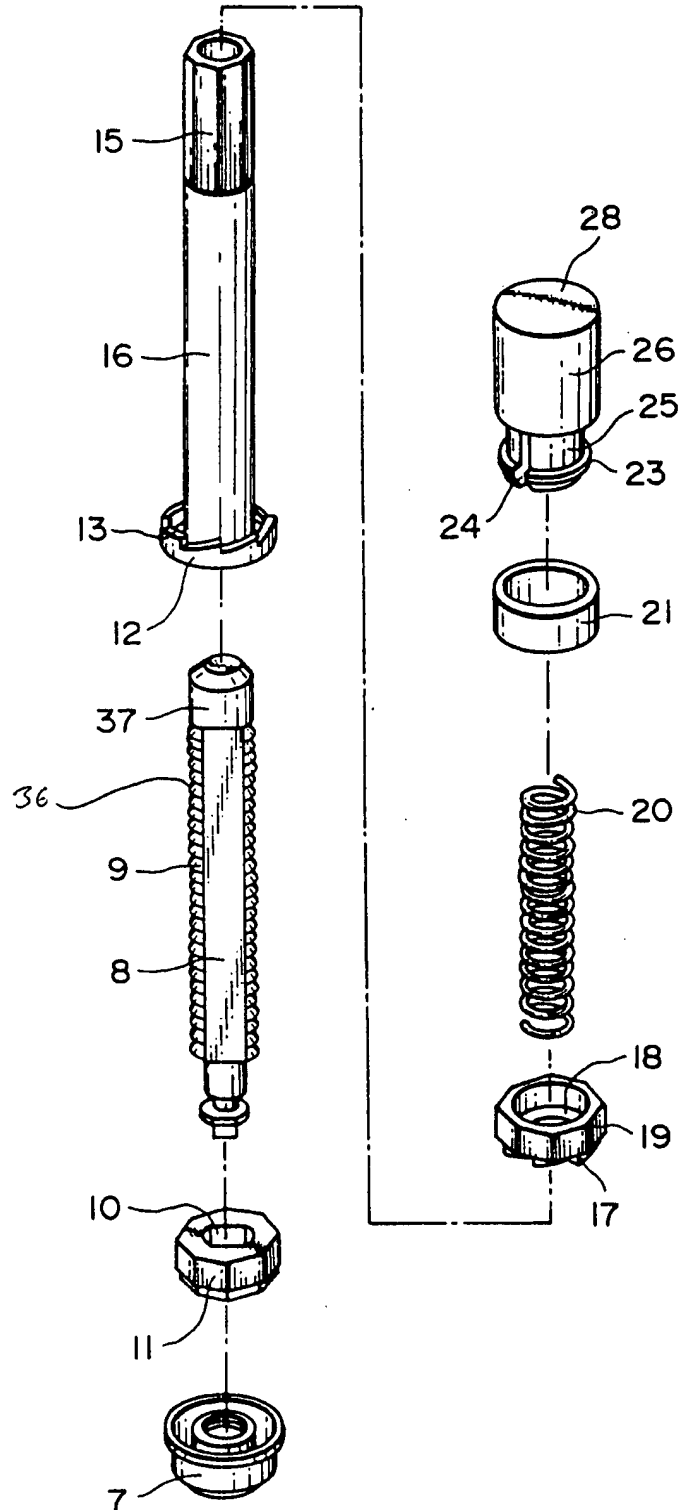


FIG. 4



LIQUID APPLICATOR

The present invention relates to a liquid applicator, for example a writing instrument such as a

5 marking pen, or a cosmetic instrument such as an eyeliner or the like, suitable for applying a liquid such as inks, paints, cosmetic liquids such as nail polish, liquid drugs, adhesives and the like, and more particularly to a liquid applicator in which the liquid is forcibly supplied to a liquid-application
10 member of the liquid applicator by means of a plunger means.

Hitherto, in this kind of liquid applicator, a plunger for pushing the liquid is axially movably mounted in a liquid reservoir of the applicator. A rear-
15 end portion of the plunger is integrally connected with a threaded rod which is threadably engaged with a rotary shaft which is manually operated by the user through a control knob so as to axially drive the plunger forward in the liquid reservoir. In such a conventional liquid
20 applicator, it is not possible for the user to check whether or not the plunger reaches the bottom of the liquid reservoir. In other words, in the conventional

liquid applicator, it is not possible for the user to check whether or not the liquid contained in the reservoir is exhausted. Consequently, in this respect,
5 the conventional liquid applicator is disadvantageous in ease of use.

According to the present invention, there is provided a liquid applicator provided with a liquid-application member to which a liquid is forcibly
10 supplied by means of a plunger means, comprising;
a shaft sleeve, said liquid-application member being mounted on a front-end portion of said shaft sleeve; a liquid reservoir provided in the interior of said shaft sleeve in a position behind said liquid-
15 application member; said plunger means being axially movably mounted in said liquid reservoir in a liquid-tight manner; a substantially cylindrical threaded rod provided with at least one flat-surface portion in its side surface, said threaded rod being connected with
20 said plunger means and axially extending rearwardly thereof, an outer periphery of said threaded rod being threaded, and said threaded rod being provided with such an axial length in its threaded portion that a front end of said threaded portion is axially coincident with a
25 rear end of a plate-like rotation-stopper means when said plunger reaches its uppermost position in said liquid reservoir, and a rear end of said threaded portion is axially coincident with a rear end of a female screw portion of a rotary shaft when said plunger
30 reaches the bottom of said liquid reservoir; said rotation-stopper means being fixedly mounted in the interior of said shaft sleeve in a position immediately behind said liquid reservoir, said rotation-stopper means being provided with a central through-hole which
35 is identical in cross section with said threaded portion of said threaded rod and axially slidably receives said

threaded rod therein; said rotary shaft being mounted in said shaft sleeve so as to be stationary in its axial direction while being rotatable about its axis relative to said shaft sleeve, said rotary shaft being threadably engaged with said threaded rod; a unidirectional means for permitting said rotary shaft to rotate in only one direction, said unidirectional means being fixedly mounted on said rotary shaft; a spring means for axially urging said rotary shaft forward; a control knob rotatably mounted on a rear-end portion of said shaft sleeve, said control knob being connected with said rotary shaft so as to be rotated integrally with said rotary shaft while being axially movable relative to said rotary shaft.

15 In a preferred embodiment a ratchet mechanism is employed to permit rotation of said shaft in one direction only.

When such a ratchet mechanism is provided this may comprise teeth formed on a flange at one end of the shaft and a support ring. The flange and support ring may be biased into contact by means of a spring.

An embodiment of the present invention will now be described by way of example and with reference to the accompanying drawings, in which:-

25 Fig. 1 is a longitudinal sectional view of an embodiment of the liquid applicator of the present invention, which embodiment constitutes a nail-polish applicator;

Fig. 2 is a cross-sectional view of the embodiment shown in Fig. 1, taken along the line II-II of Fig. 1;

Fig. 3 is a cross-sectional view of the embodiment shown in Fig. 1, taken along the line III-III of Fig. 1;

Fig. 4 is an exploded view of part of the embodiment shown in Fig. 1.

In the drawings, the reference numeral 6 denotes a shaft sleeve constituting a main body of a nail-polish applicator which is an embodiment of the present invention. The shaft sleeve 6 is provided with a small-diameter front-end portion 1 and a main body portion 2 which is provided with: a liquid reservoir 4 containing a nail polish 3, the reservoir 4 being formed in a front part of the main body portion 2; and a many-sided polygonal portion 5 which has a suitable polygonal shape such as a regular octagonal shape in its cross section, the many-sided polygonal portion 5 being formed in a rear part of the main body portion 2.

In the liquid reservoir 4 is provided a plunger 7 for forcibly supplying the nail polish 3 to a liquid-application member 33. The plunger 7 is brought into a liquid-tight contact with an inner wall of the liquid reservoir 4 so as to be axially slidable in the liquid reservoir 4.

A rear-end portion of the plunger 7 is integrally

1 connected with a threaded rod 9 provided with a threaded
portion 36. As is clearly shown in Figs. 2 and 4, a pair
of opposite flat-surface portions 8, 8' are provided
on the threaded rod 9 in its peripheral portion. In addi-
5 tion, the threaded rod 9 is provided with a non-threaded
portion 37 at its rear end. The non-threaded portion
37 of the threaded rod 9 may be as short as possible.

On the other hand, the threaded portion 36 of
the threaded rod 9 has such an axial length that a front
10 end of the threaded portion 36 is axially coincident
with a rear end of a plate-like rotation-stopper means
11 when the plunger 7 reaches its uppermost position
in the liquid reservoir 4; and a rear end of the threaded
portion 36 is axially coincident with a rear end of a
15 female screw portion of a rotary shaft 16 when the plunger
7 reaches the bottom of the liquid reservoir 4. In Fig.
1, the reference character L_1 denotes such axial length
of the threaded portion 36 of the threaded rod 9. The
axial length L_1 of the threaded portion 36 is substan-
20 tially equal to the sum of an axial stroke L_2 of the
plunger 7 in the liquid reservoir 4 and an axial length
of the female screw portion of the rotary shaft 16.

As shown in Fig. 2, the plate-like rotation-
stopper means 11 assumes a regular octagonal shape in
25 its cross section, and is snugly and fixedly mounted

1 in a front-end part of the many-sided polygonal portion
5 of the shaft sleeve 6 so as to be prevented from rotating relative to the shaft sleeve 6. The rotation-stopper means 11 is provided with a central through-hole 10 which
5 has the same shape in cross section as that of the threaded rod 9, but is slightly larger in cross section than the threaded rod 9. The threaded rod 9 passes through the central through-hole 10 of the rotation-stopper means 11 so that the threaded rod 9 is prevented from rotating
10 on its axis relative to the shaft sleeve 6 by means of the rotation-stopper means 11 while being axially movable in the central through-hole 10 of the rotation-stopper means 11.

In an area behind the rotation-stopper means
15 11 in the interior of the many-sided polygonal portion 5 of the shaft sleeve 6, the rotary shaft 16 is threadably connected with the threaded rod 9. The rotary shaft 16 has in cross section a regular octagonal shape in its outer peripheral portion, and has a central circular
20 hole. In a front-end portion of the rotary shaft 16 is formed a flange 12 a rear portion of which is formed with a ratchet 13.

In an inner wall of a front-end portion of the rotary shaft 16 is provided the female screw portion
25 threadably engaged with the threaded portion 36 of the

1 threaded rod 9. A rear-end portion 15 of the rotary shaft
16 is formed into a regular octagonal shape in its cross
section. The threaded rod 9 is slidably inserted in the
central circular hole of the rotary shaft 16, so that the
5 threaded portion 36 of the threaded rod 9 is threadably
engaged with the female screw portion of the rotary shaft
16.

A ring-like spring support 19 is movably mounted
on the rotary shaft 16 in a position adjacent to the
10 rear surface of the flange 12 of the rotary shaft 16,
while being prevented from rotating relative to the shaft sleeve
6. The spring support 19 has in cross section a regular
octagonal shape in its outer peripheral portion.
In a front-end portion of the spring support 19 is pro-
15 vided an inner flange extending radially inwardly to
form a seat portion 18, a front portion of which inner
flange is formed into a ratchet means 17 which engages
with the ratchet means 13 of the rotary shaft 16 to real-
ize a unidirectional movement of the rotary shaft 16.

20 Thus, through engagement of the ratchet means
13 and 17, the rotary shaft 16 is permitted to rotate
only in a clockwise direction in the exploded view shown
in Fig. 4 so that the threaded rod 9 is axially moved
forward relative to the rotary shaft 16. In other words,
25 the rotary shaft 16 is prevented from being rotated in

1 a counterclockwise direction in the exploded view.

A set element 21 for preventing a tubular control knob 28 from dropping out of the shaft sleeve 6 is fixedly mounted in a rear-end portion of the shaft sleeve 6.

5 The tubular control knob 28 with a closed rear end is identical in outer diameter with the shaft sleeve 6. A bore of the control knob 28 has a regular octagonal shape in cross section for receiving a rear-end portion of the threaded rod 9 therein. A front portion of
10 the control knob 28 is formed into a small-diameter cylindrical portion 25 which extends forward. In a front-end portion of the small-diameter portion 25 is provided a radial projection 23 bulging radially outwardly. Inside the radial projection 23 is provided a shoulder portion
15 forming a seat 22. In the small-diameter portion 25 of the control knob 28 are provided a pair of diametrically opposed axial slits 24 which permit the small-diameter portion 25 of the control knob 28 to be resiliently radially inwardly deformed. The control knob 28 is
20 rotatably mounted in the rear-end portion of the shaft sleeve 6 through the set element 21 in a condition in which the radial projection 23 of the control knob 28 is engaged with a front-end portion of the set element 21.

25 Between the spring support 19 and the seat 22

1 of the control knob 28 is mounted a compression coil
spring 20 so that the outer periphery of the rotary shaft
16 is surrounded by the coil spring 20. Under the influ-
ence of a resilient force exerted by the coil spring
5 20, a front surface of the flange 12 of the rotary shaft
16 is constantly pressed against a rear surface of the
rotation-stopper means 11 so as to position the rotary
shaft 16 in the axial direction of the shaft sleeve 6.

A joint member 31 is press-fitted into the
10 front-end portion 1 of the shaft sleeve 6 in a liquid-
tight manner. A recessed portion 29 is provided in a
front-end portion of the joint member 31. In addition,
a central through-hole 30 is so provided in the joint
member 31 as to axially extend from a central part of
15 the recessed portion 29 to a rear-end surface of the
joint member 31.

A guide pipe 32 is mounted in the central through-
hole 30 of the joint member 31 to reach an axially inter-
mediate portion of the central through-hole 30, while
20 axially extended forward from the joint member 31 by
a predetermined length.

The thus extended portion of the guide pipe 32
is surrounded with a liquid-application member 33 having
a brush-like form. A rear-end portion of the liquid-
25 application member 33 is fixedly mounted in the recessed

1 portion 29 of the joint member 31.

 In the drawings: the reference numeral 34 denotes
a mouthpiece which covers an outer periphery of the
liquid-application member 33; and 35 a cap.

5 Any of parts of the nail-polish applicator of
the above embodiment of the present invention can be
made of conventional materials such as rigid synthetic
resins.

 Now, operation of the nail-polish applicator
10 of the above embodiment of the present invention will
be described hereinafter.

 In use, when the control knob 28 is rotated by
the user, the rotary shaft 16 fitted to the regular-
octagonal hole of the control knob 28 is also rotated
15 together with the control knob 28. At this time, since
the threaded rod 9 threadably engaged with the rotary
shaft 16 is prevented from rotating by means of the
rotation-stopper means 11, the threaded rod 9 is axially
moved relative to the rotary shaft 16. As described above,
20 the ratchet means 13 and 17 permit the rotary shaft 16
to rotate in only one direction so as to axially
move the threaded rod 9 forward. When the plunger 7 is
axially moved forward in the liquid reservoir 4 by means
of the thus moved threaded rod 9, the nail polish 3 con-
25 tained in the liquid reservoir 4 is forced to be supplied

1 to the liquid-application member 33 through the central
through-hole 30 of the joint member 31 and the guide
pipe 32.

5 When the plunger 7 reaches the bottom of the
liquid reservoir 4, the female screw portion of the rotary
shaft 16 reaches the rear-end part of the threaded portion
36 of the threaded rod 9 to make it impossible to rotate
the rotary shaft 16 any more. Naturally, it becomes also
impossible to rotate the control knob 28 any more, whereby
10 it is possible for the user to know the fact that the
plunger 7 reaches the bottom of the liquid reservoir
4, i.e., to know the fact that the liquid contained in
the liquid reservoir 4 is completely exhausted.

CLAIMS

1. A liquid applicator provided with a liquid-application member to which a liquid is forcibly supplied by means of a plunger means, comprising;
 - 5 a shaft sleeve, said liquid-application member being mounted on a front-end portion of said shaft sleeve; a liquid reservoir provided in the interior of said shaft sleeve in a position behind said liquid-application member; said plunger means being axially
 - 10 movably mounted in said liquid reservoir in a liquid-tight manner; a substantially cylindrical threaded rod provided with at least one flat-surface portion in its side surface, said threaded rod being connected with said plunger means and axially extending rearwardly
 - 15 thereof, an outer periphery of said threaded rod being threaded, and said threaded rod being provided with such an axial length in its threaded portion that a front end of said threaded portion is axially coincident with a rear end of a plate-like rotation-stopper means when
 - 20 said plunger reaches its uppermost position in said liquid reservoir, and a rear end of said threaded portion is axially coincident with a rear end of a female screw portion of a rotary shaft when said plunger reaches the bottom of said liquid reservoir; said
 - 25 rotation-stopper means being fixedly mounted in the interior of said shaft sleeve in a position immediately behind said liquid reservoir, said rotation-stopper means being provided with a central through-hole which is identical in cross section with said threaded portion
 - 30 of said threaded rod and axially slidably receives said threaded rod therein; said rotary shaft being mounted in said shaft sleeve so as to be stationary in its axial direction while being rotatable about its axis relative to said shaft sleeve, said rotary shaft being threadably
 - 35 engaged with said threaded rod; a unidirectional means for permitting said rotary shaft to rotate in only one

direction, said unidirectional means being fixedly mounted on said rotary shaft; a spring means for axially urging said rotary shaft forward; a control knob rotatably mounted on a rear-end portion of said shaft sleeve, said control knob being connected with said rotary shaft so as to be rotated integrally with said rotary shaft while being axially movable relative to said rotary shaft.

2. A liquid applicator as claimed in claim 1, wherein said unidirectional means comprises a ratchet gearing.

3. A liquid applicator as claimed in claim 1 or 2, wherein a pair of diametrically opposed flat-surface portions are provided in said threaded rod.

4. A liquid applicator substantially as hereinbefore described with reference to the accompanying drawings.
